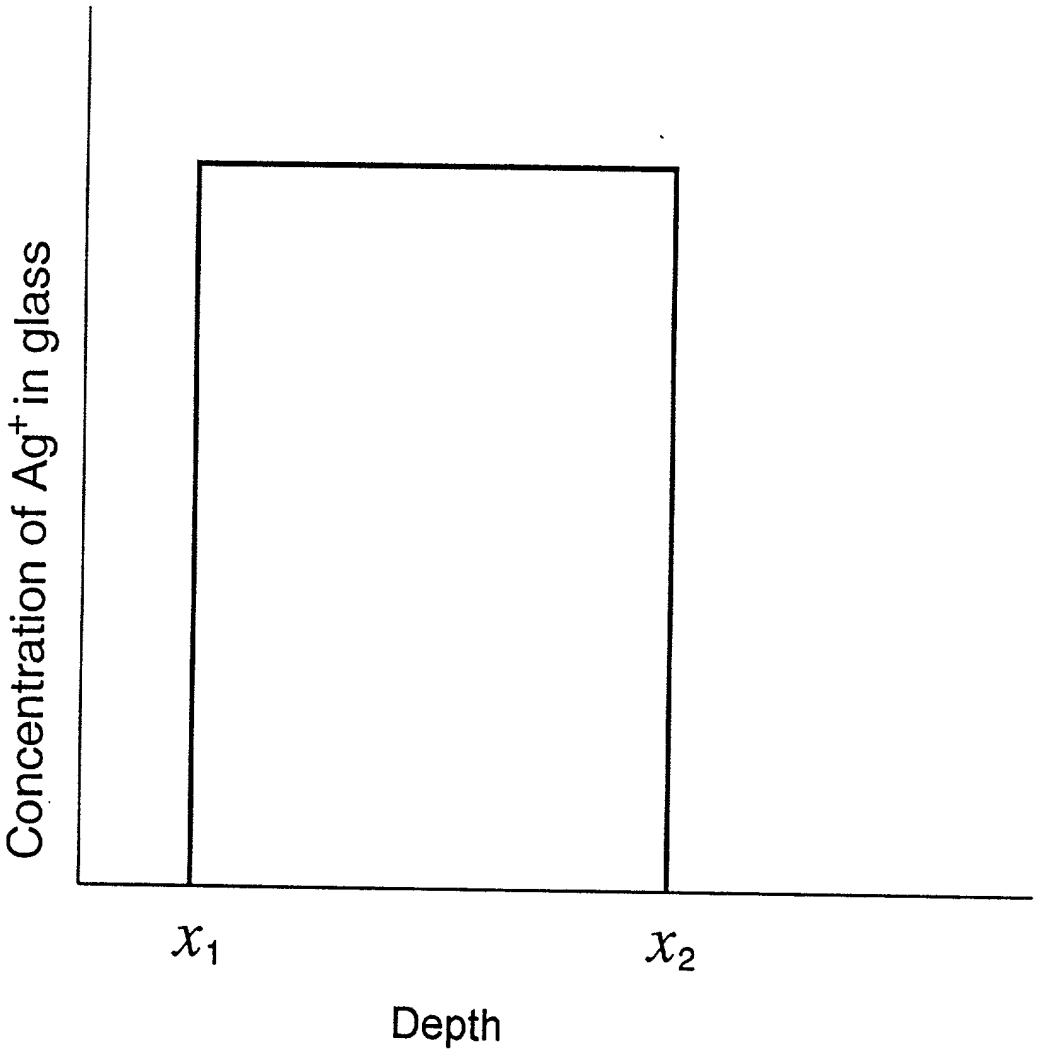


Fig. 1

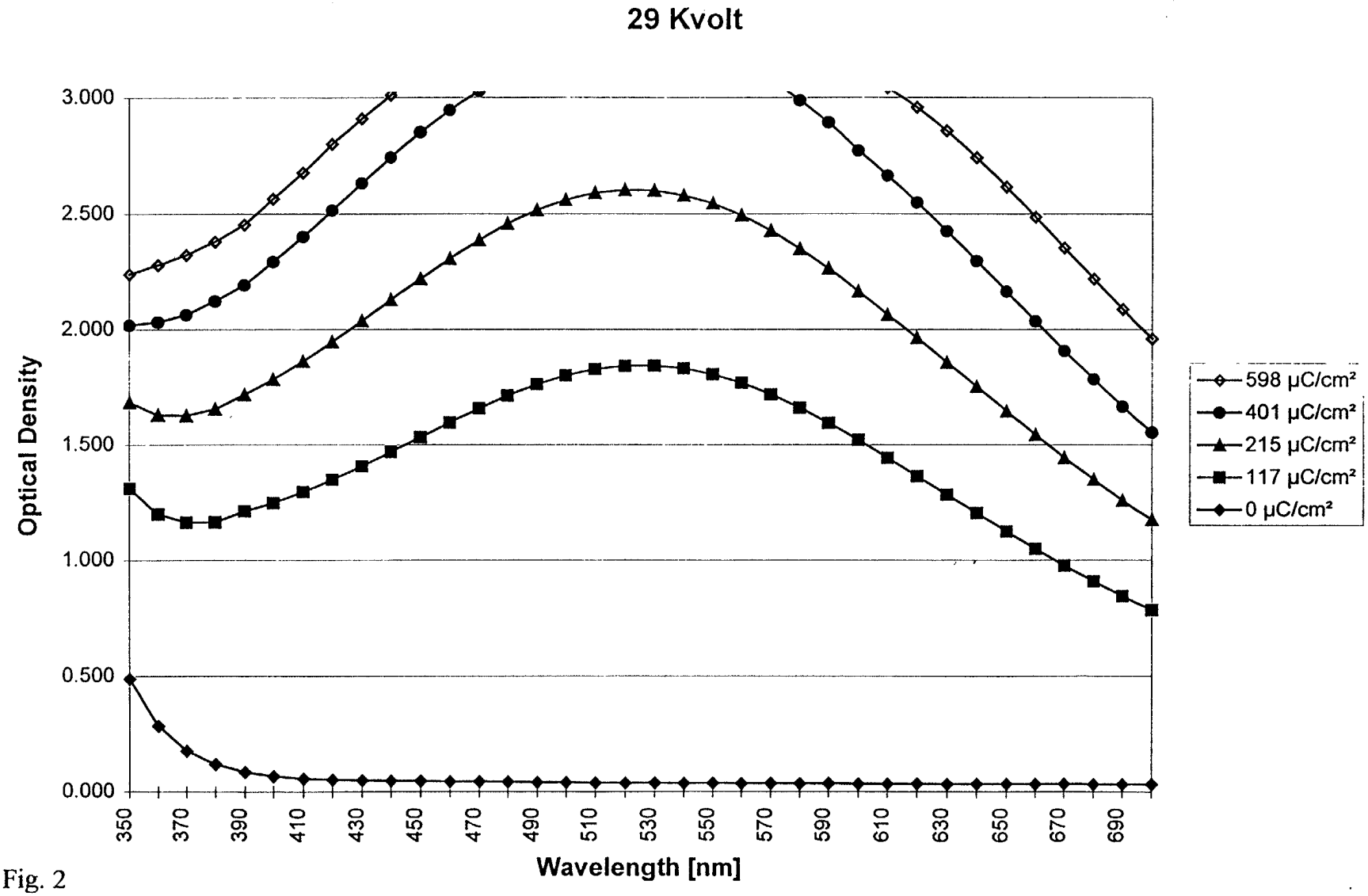


Fig. 2

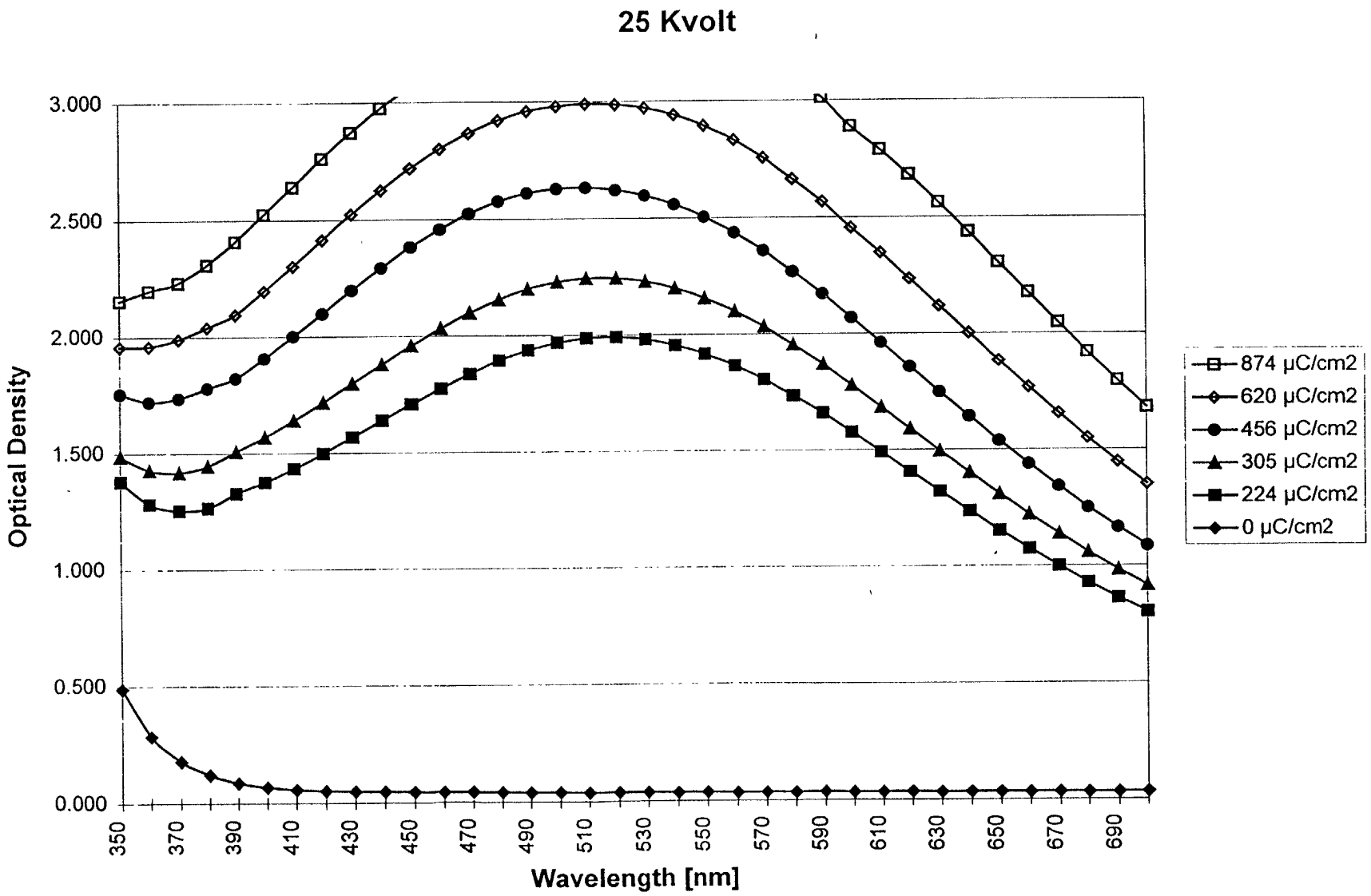


Fig. 3

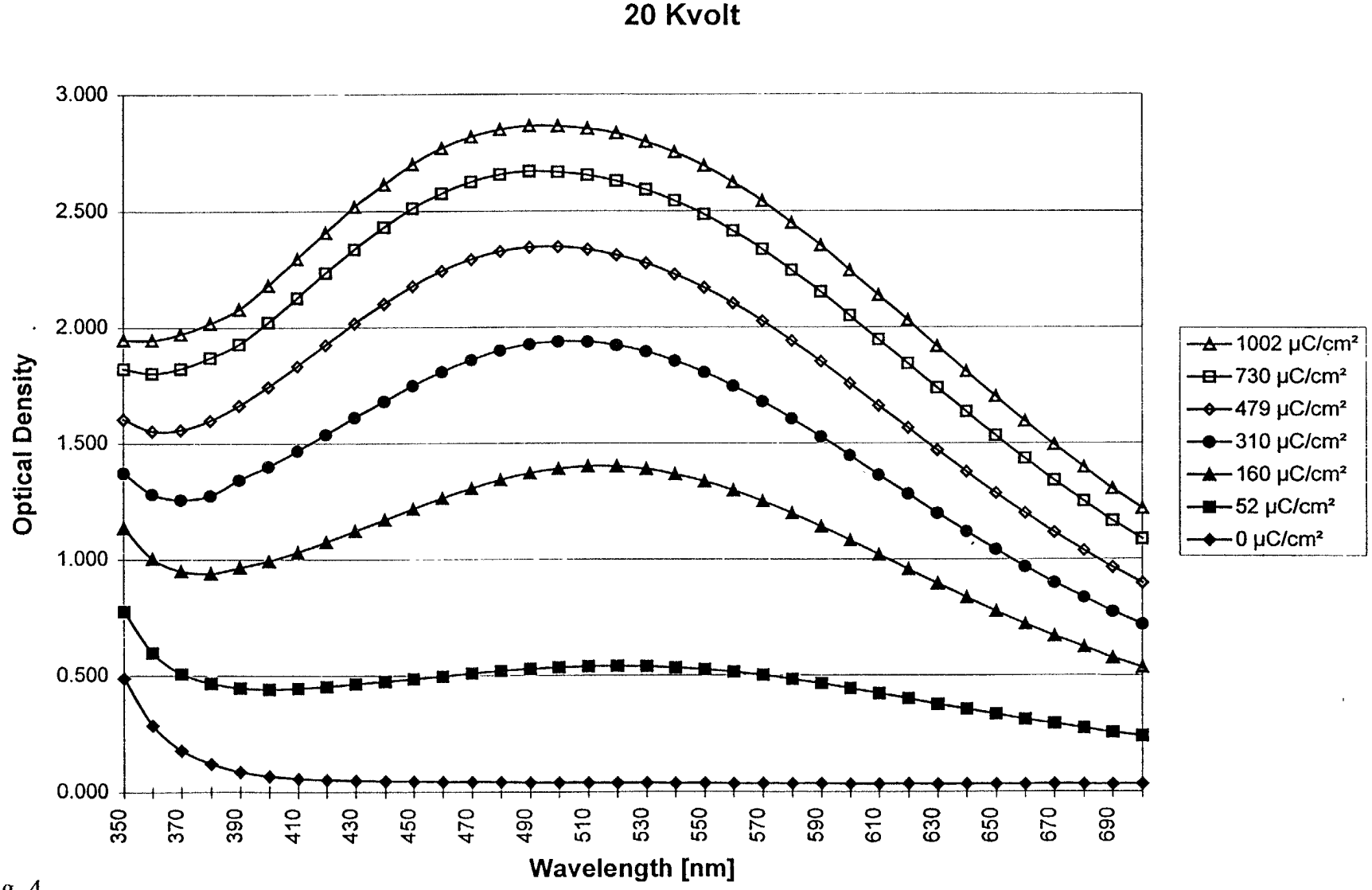


Fig. 4

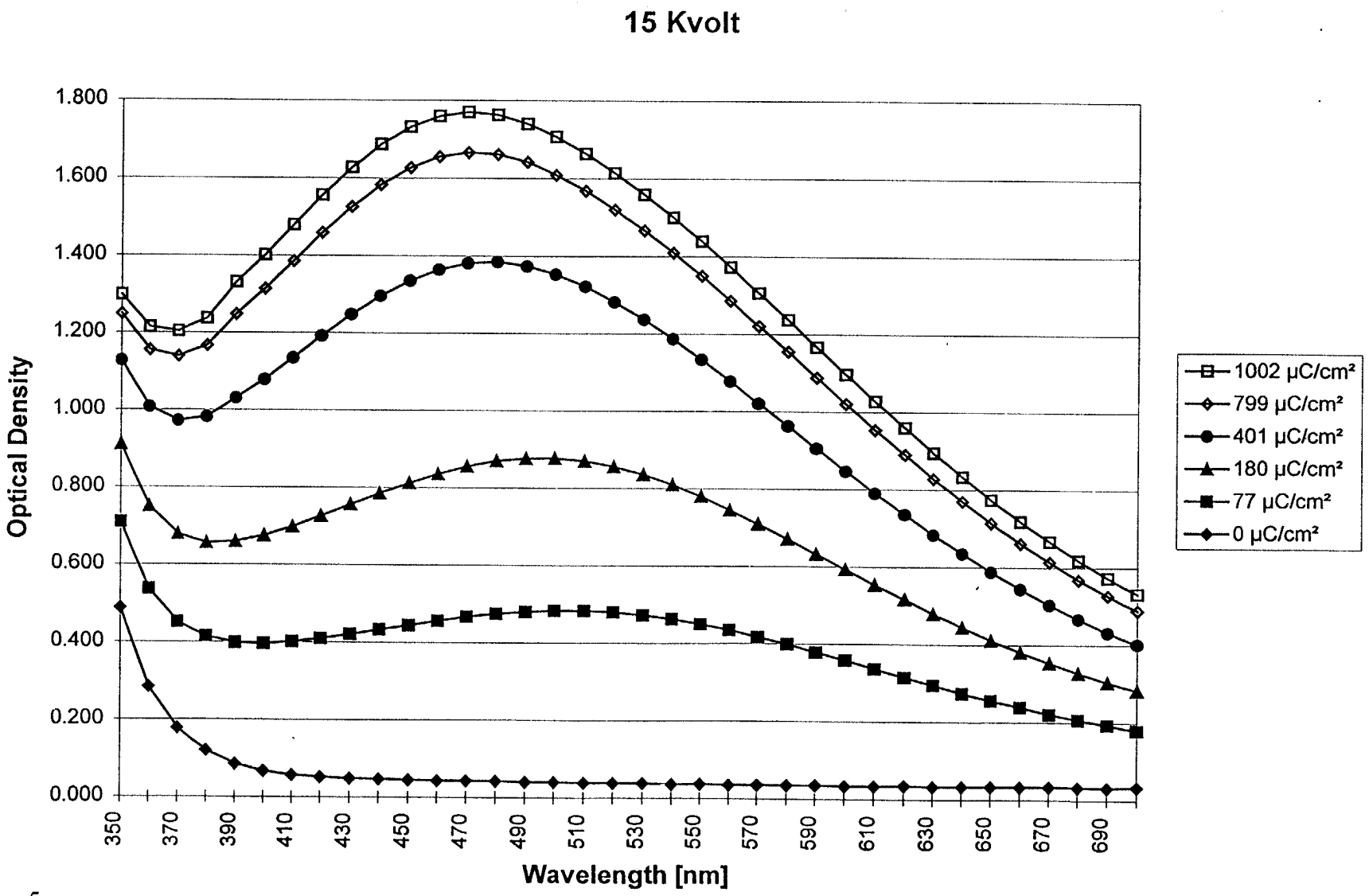


Fig. 5

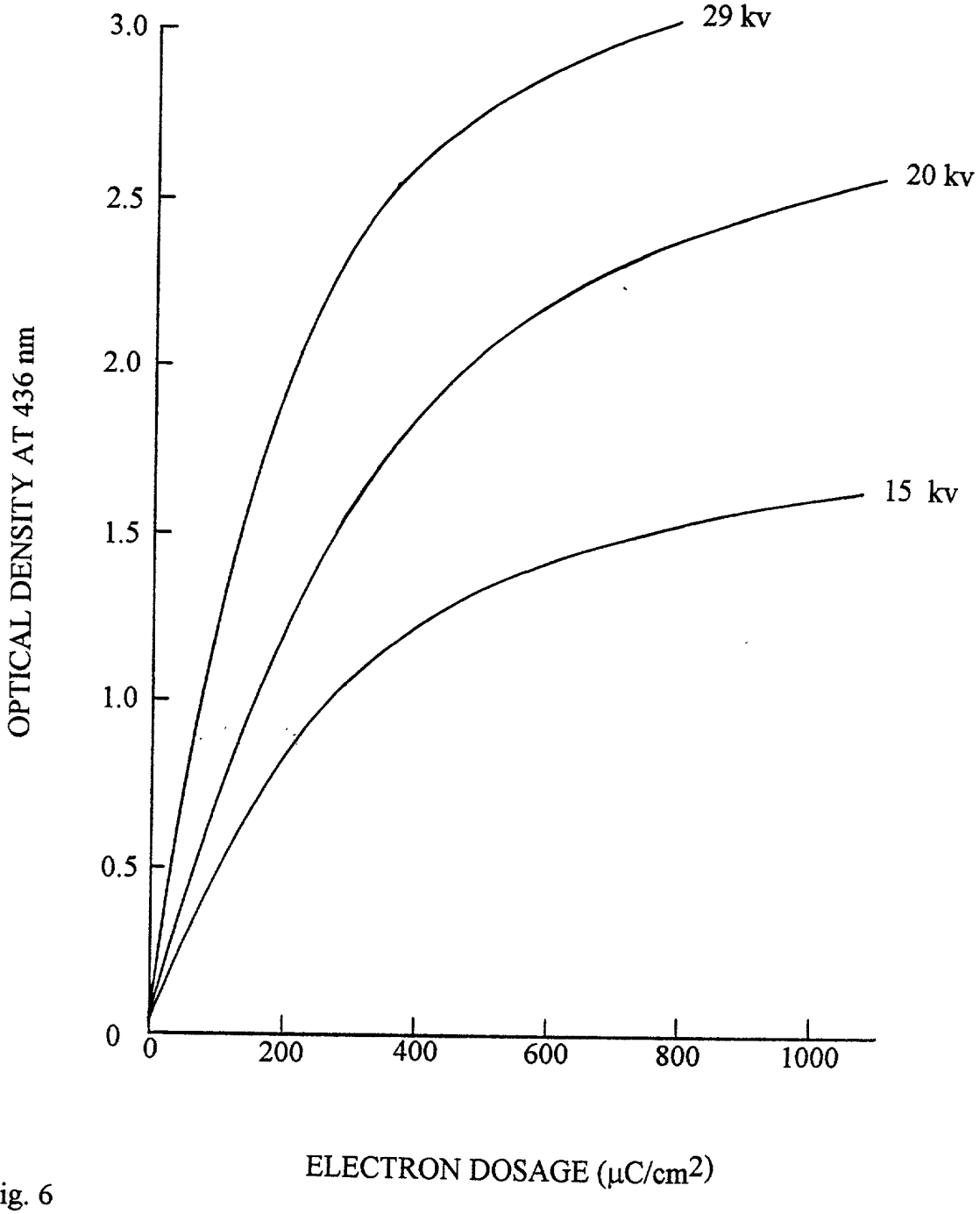

3.0
2.5
2.0
1.5
1.0
0.5
0
0
200
400
600
800
1000
29 kv
20 kv
15 kv
OPTICAL DENSITY AT 436 nm
ELECTRON DOSAGE (μC/cm2)

Fig. 6

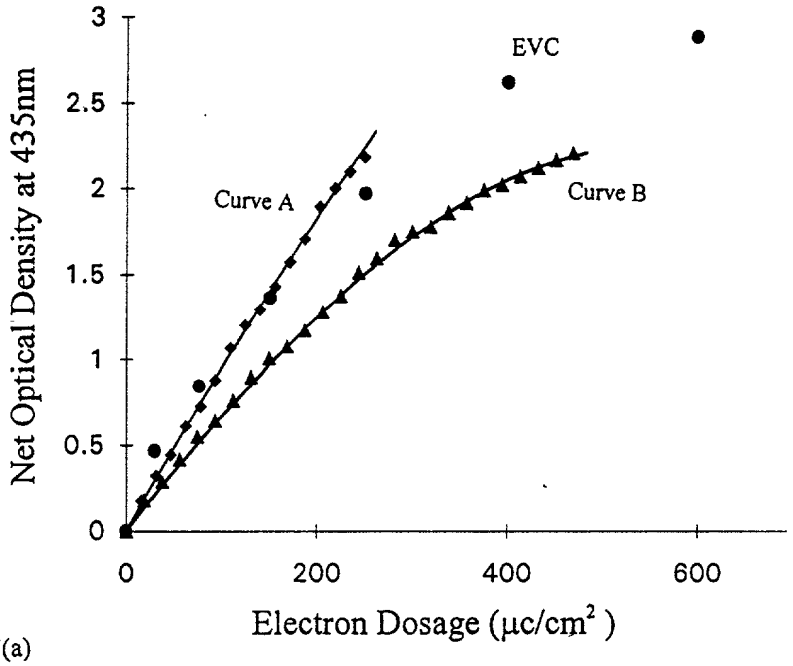

Net Optical Density at 435nm
Electron Dosage (μc/cm²)
EVC
Curve A
Curve B
0
0.5
1
1.5
2
2.5
3
0
200
400
600

Fig. 7(a)

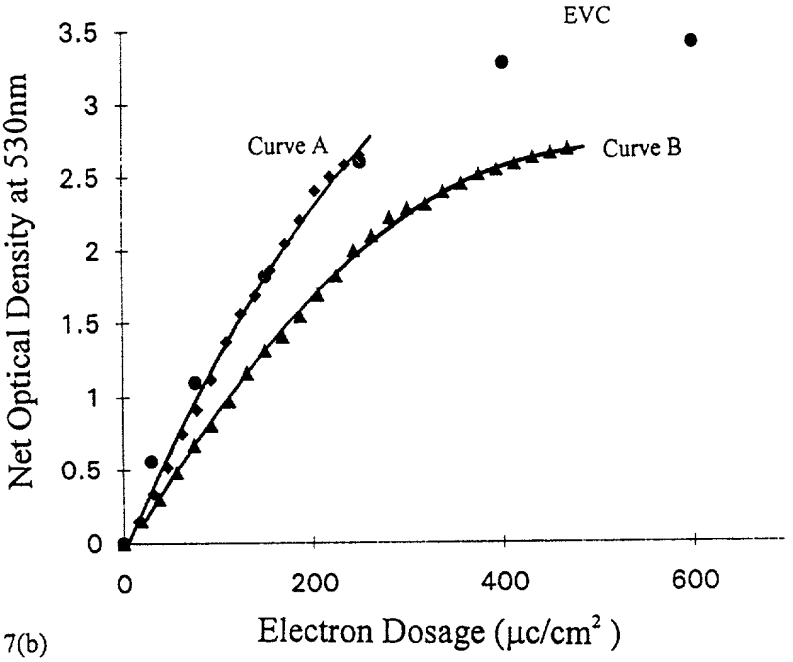

Net Optical Density at 530nm
Electron Dosage (μc/cm²)
EVC
Curve A
Curve B
0
0.5
1
1.5
2
2.5
3
3.5
0
200
400
600

Fig. 7(b)

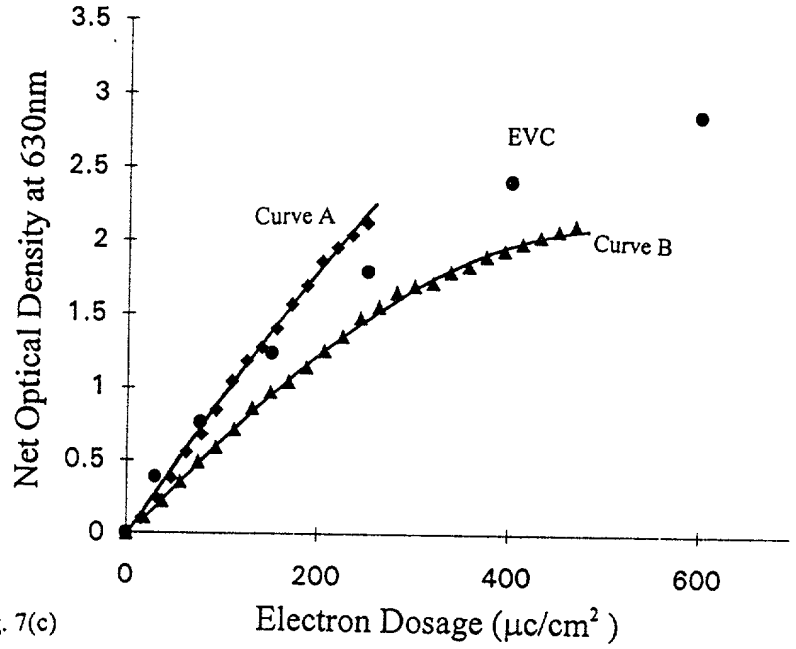


Fig. 7(c)

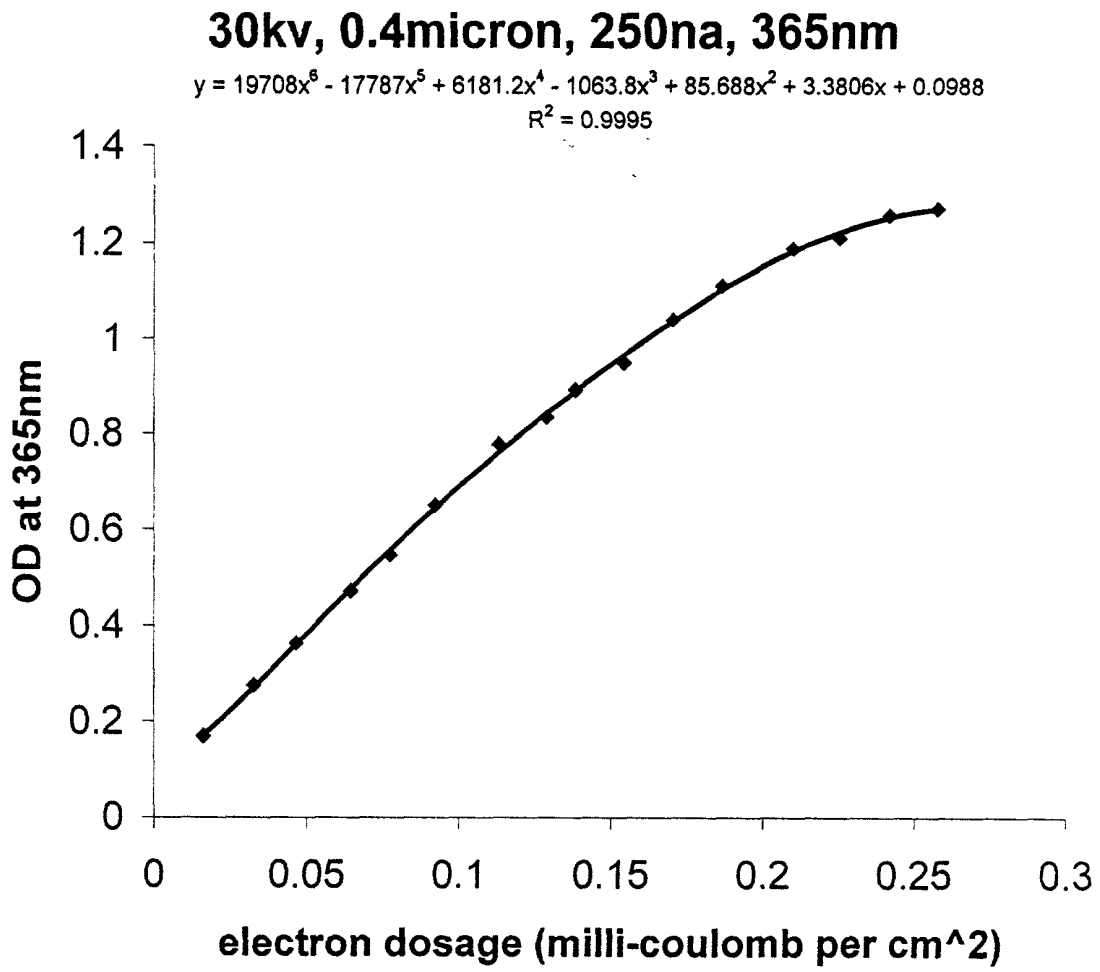

30kv, 0.4micron, 250na, 365nm
y = 19708x^6 - 17787x^5 + 6181.2x^4 - 1063.8x^3 + 85.688x^2 + 3.3806x + 0.0988
R^2 = 0.9995
OD at 365nm
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
0.05
0.1
0.15
0.2
0.25
0.3
electron dosage (milli-coulomb per cm^2)

Fig. 7 (d)

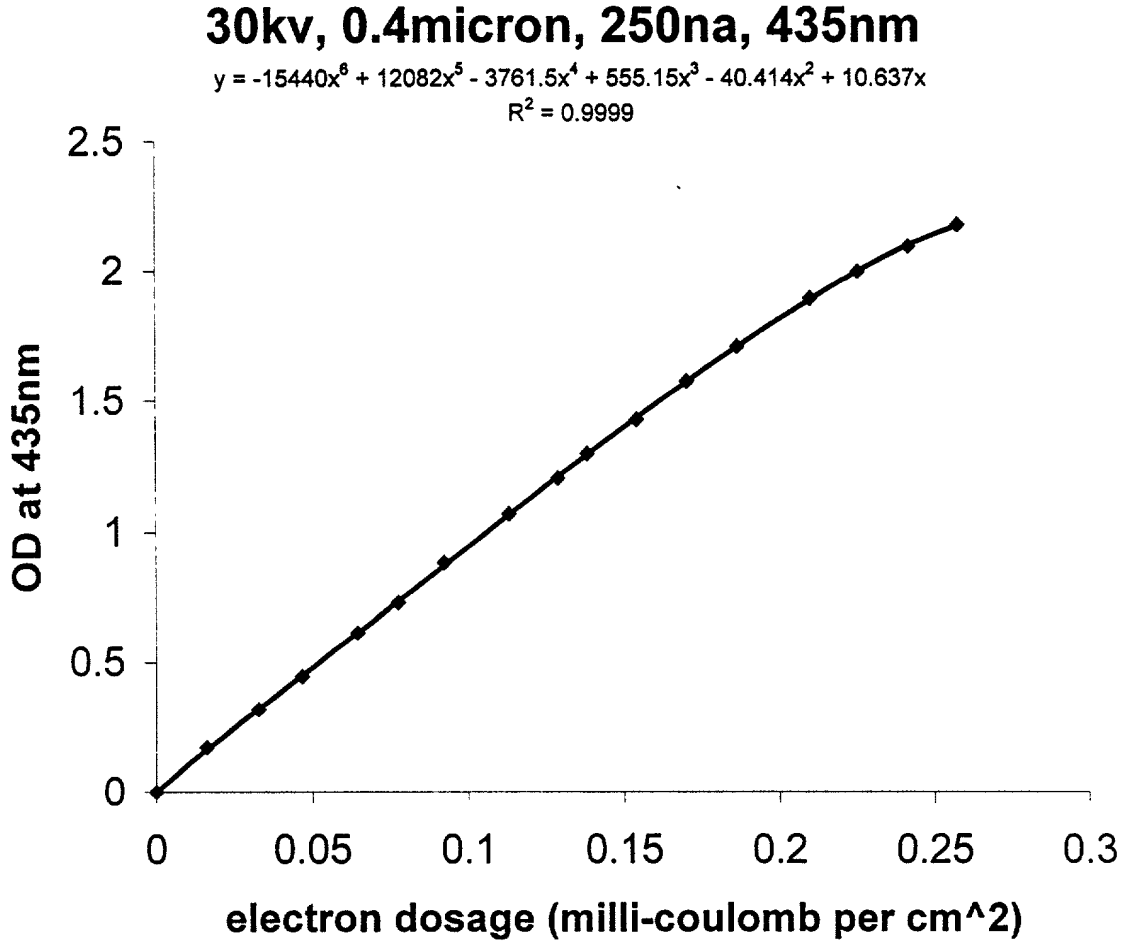

30kv, 0.4micron, 250na, 435nm
y = -15440x^6 + 12082x^5 - 3761.5x^4 + 555.15x^3 - 40.414x^2 + 10.637x
R^2 = 0.9999
OD at 435nm
2.5
2
1.5
1
0.5
0
0
0.05
0.1
0.15
0.2
0.25
0.3
electron dosage (milli-coulomb per cm^2)

Fig. 7 (e)

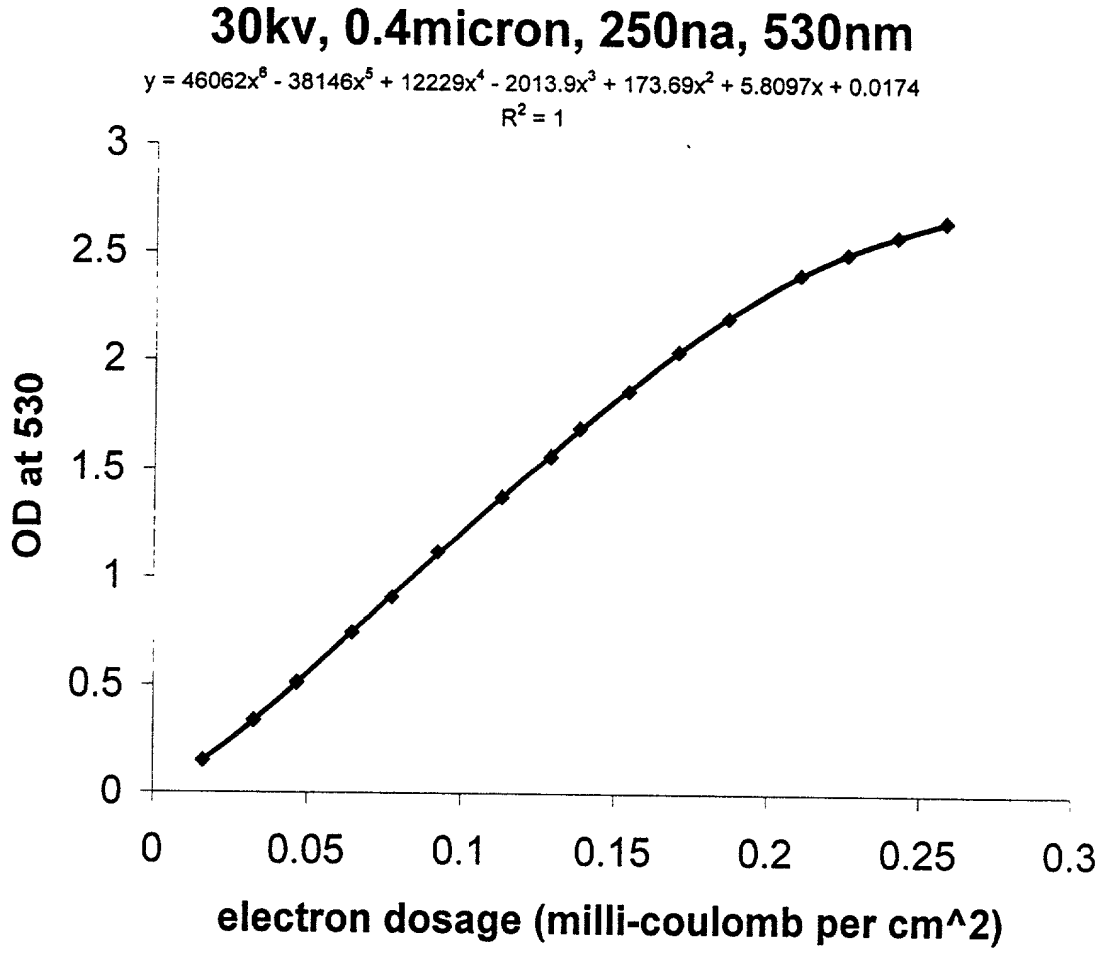


Fig. 7 (f)

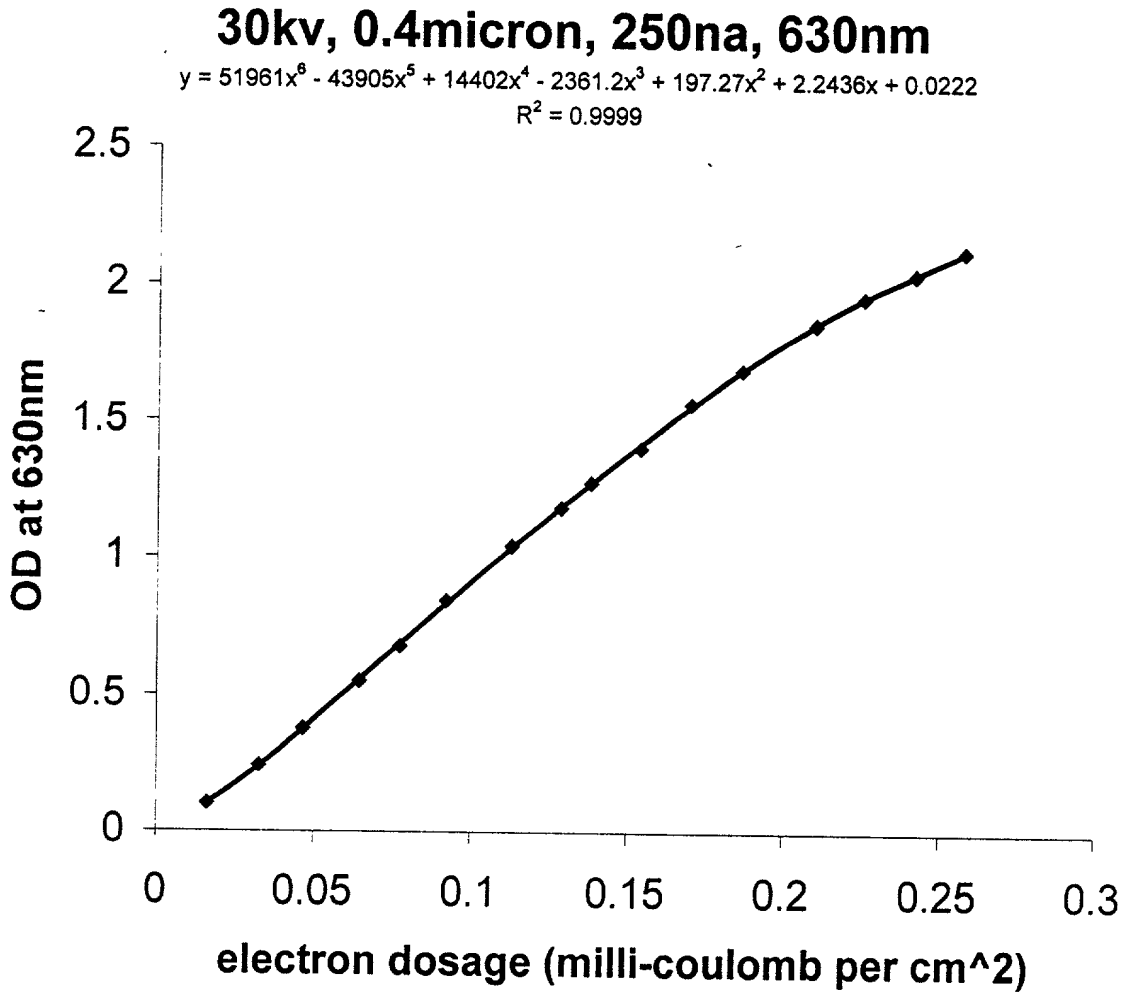

30kv, 0.4micron, 250na, 630nm
y = 51961x^6 - 43905x^5 + 14402x^4 - 2361.2x^3 + 197.27x^2 + 2.2436x + 0.0222
R^2 = 0.9999
OD at 630nm
2.5
2
1.5
1
0.5
0
0
0.05
0.1
0.15
0.2
0.25
0.3
electron dosage (milli-coulomb per cm^2)

Fig. 7 (g)

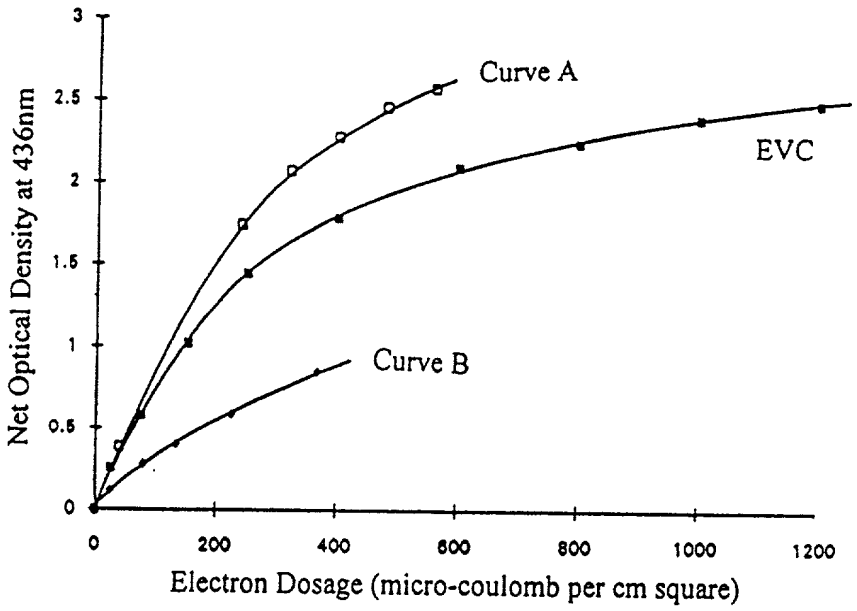

Net Optical Density at 436nm
3
2.5
2
1.5
1
0.5
0
0
200
400
600
800
1000
1200
Electron Dosage (micro-coulomb per cm square)
Curve A
EVC
Curve B

Fig. 8

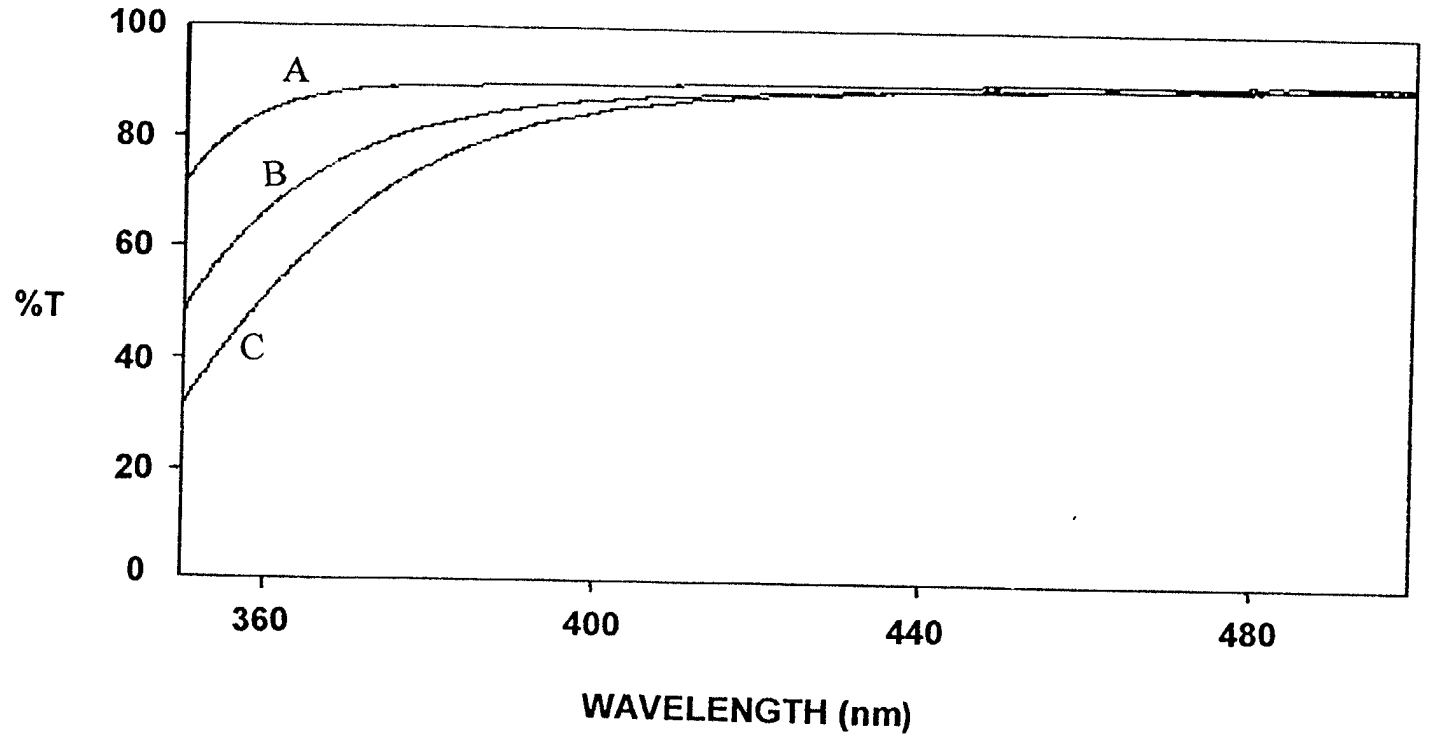


Fig. 9

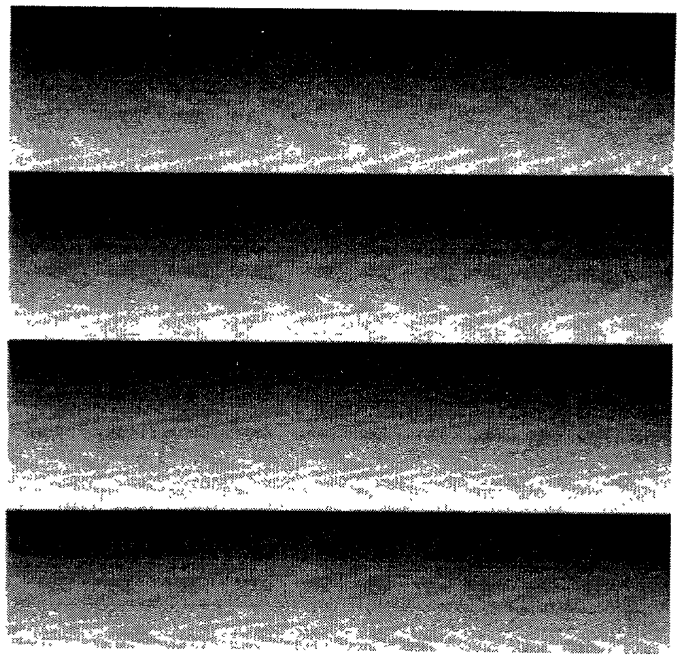


Fig. 10

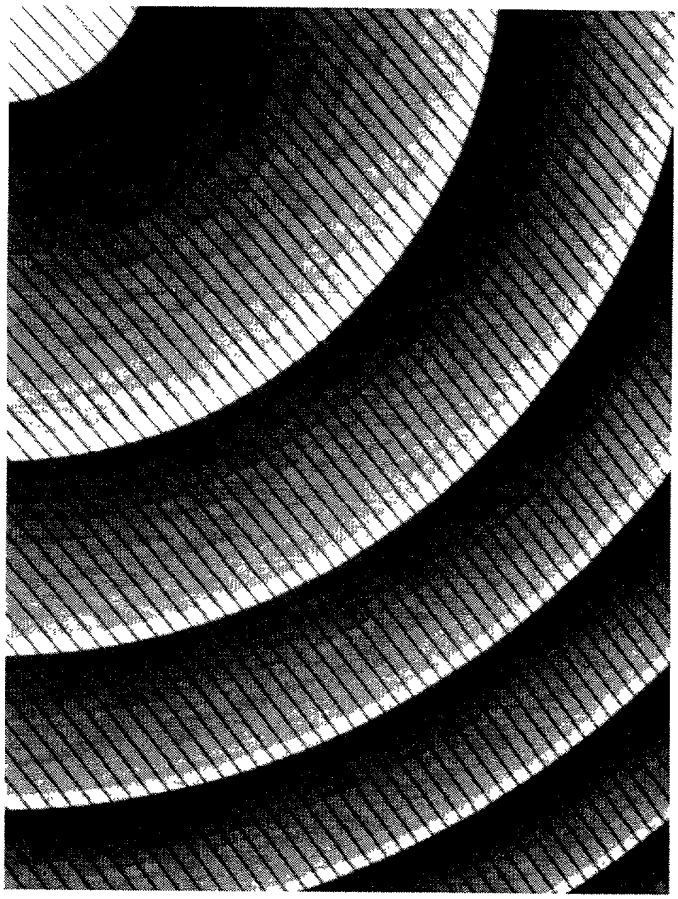


Fig. 11

a.) HEBS-Glass mask material exposed in e-beam writer

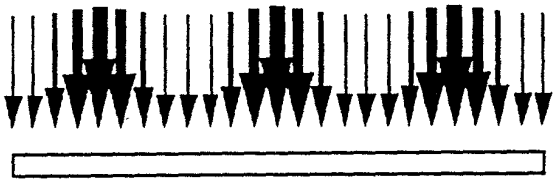
b.) Gray-Level mask generated in HEBS-Glass

c.) Photoresist exposure in optical lithography tool

d.) Resist surface profile after development

e.) Surface profile in substrate material after CAIBE transfer step

Fig. 12

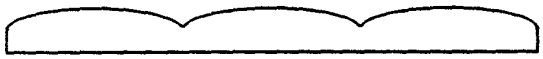


HEBS-Glass material exposed in e-beam writer

Gray-Level mask generated in HEBS-Glass

Photoresist exposure in mask-aligner

Resist surface profile after development



Lens profile after etching transfer step

Fig. 13

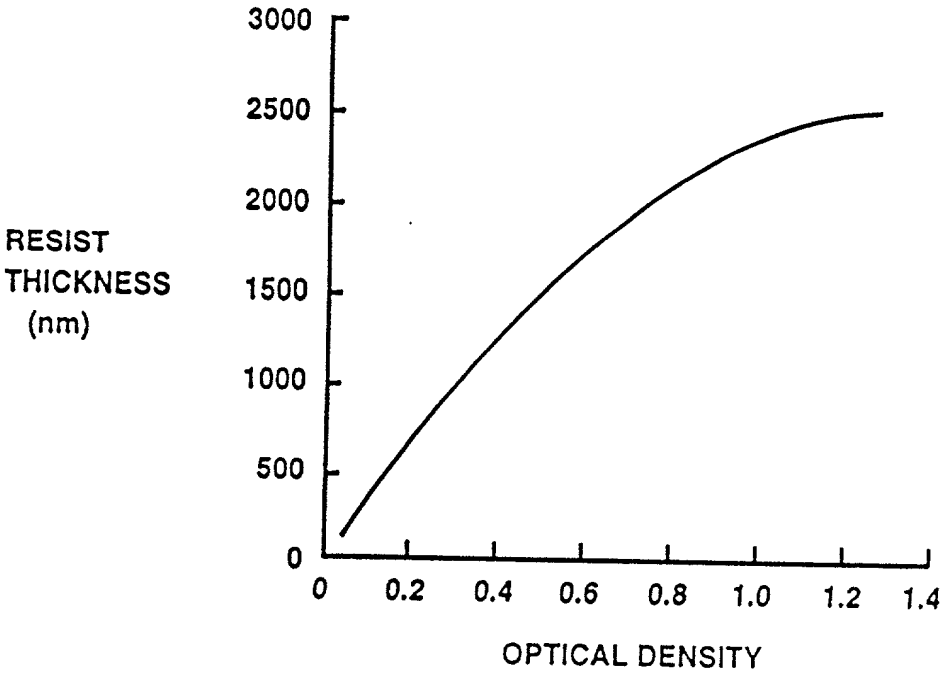


Fig. 14

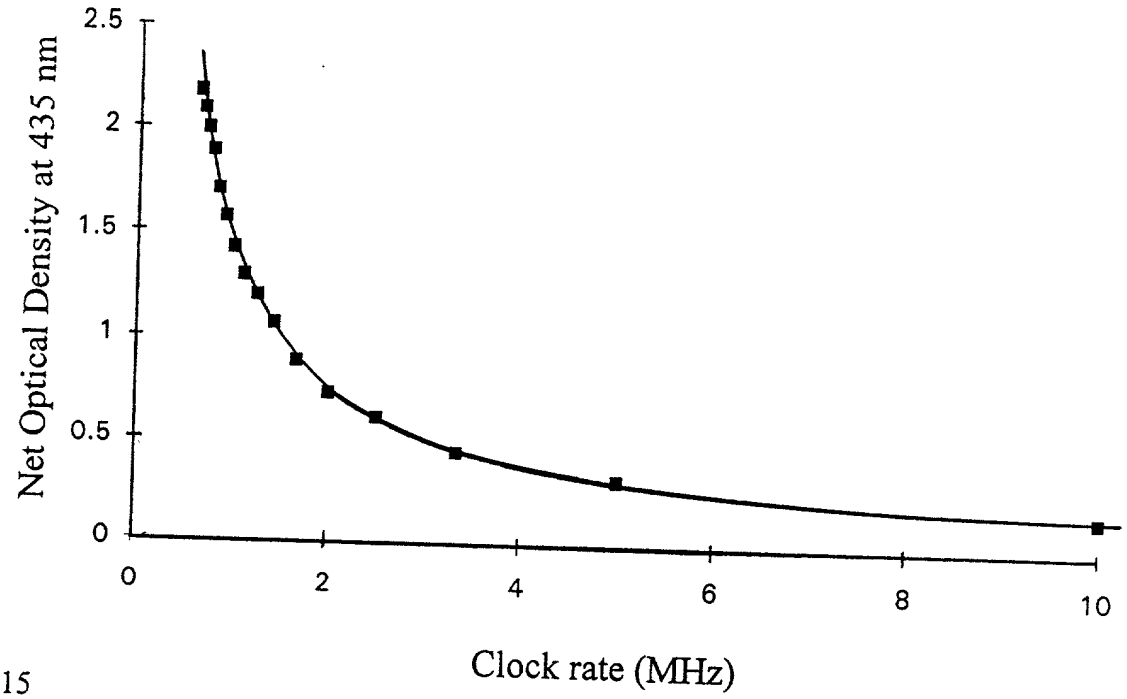

Net Optical Density at 435 nm
2.5
2
1.5
1
0.5
0
0
2
4
6
8
10
Clock rate (MHz)

Fig. 15

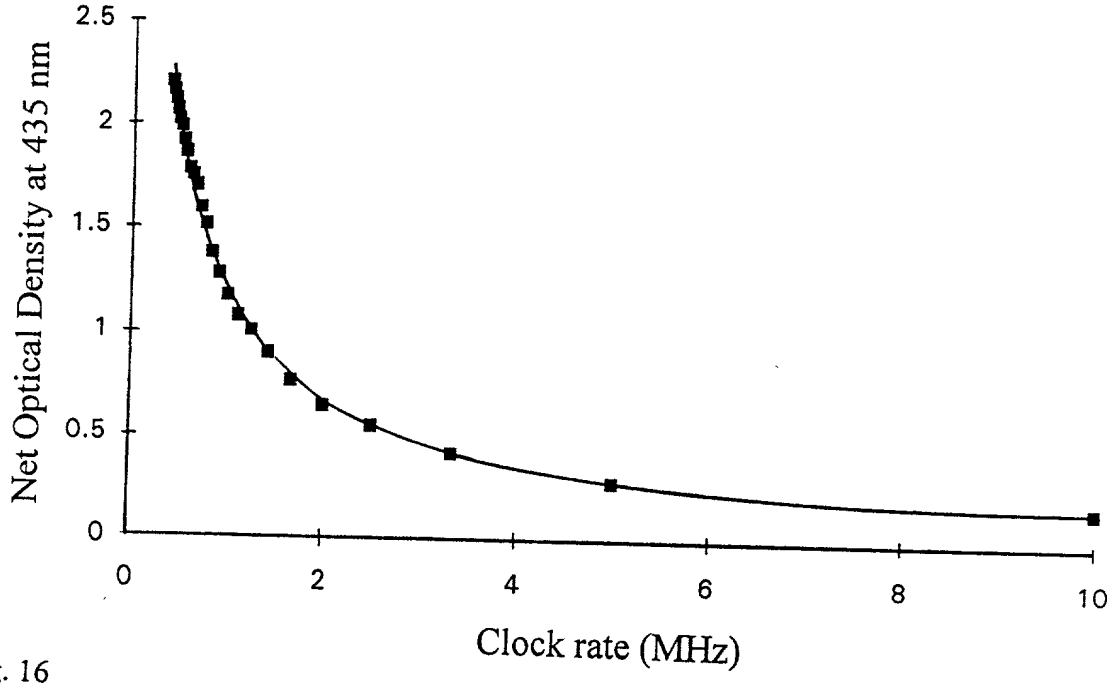

Net Optical Density at 435 nm
2.5
2
1.5
1
0.5
0
0
2
4
6
8
10
Clock rate (MHz)

Fig. 16

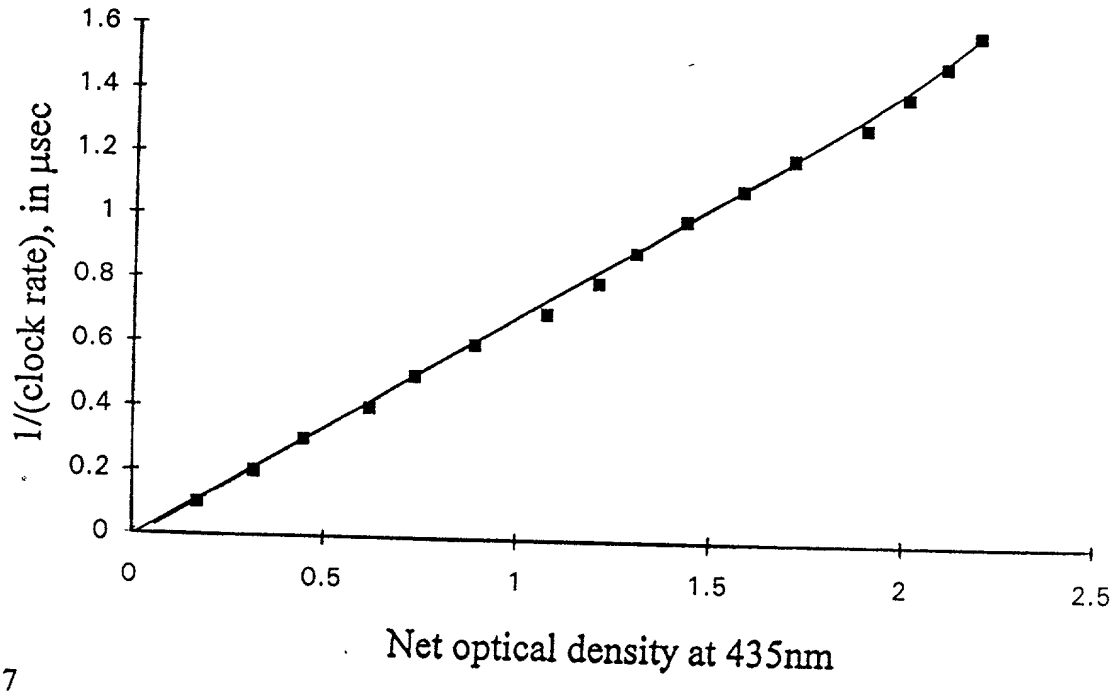
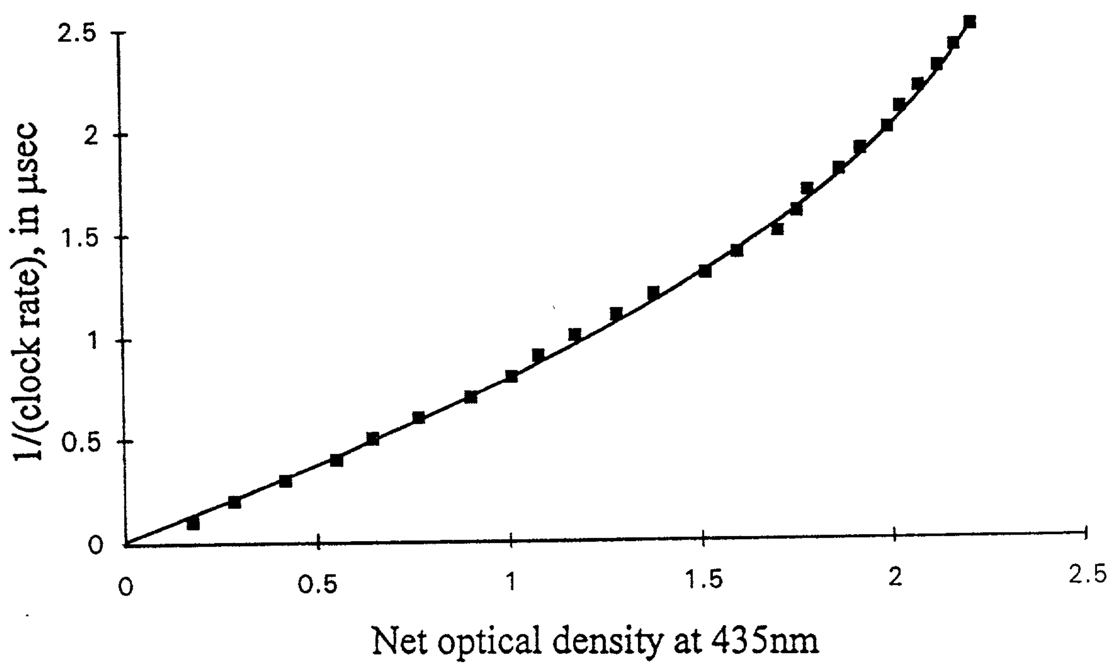

1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1/(clock rate), in µsec
0
0.5
1
1.5
2
2.5
Net optical density at 435nm

Fig. 17



1/(clock rate), in µsec
2.5
2
1.5
1
0.5
0
0
0.5
1
1.5
2
2.5
Net optical density at 435nm

Fig. 18

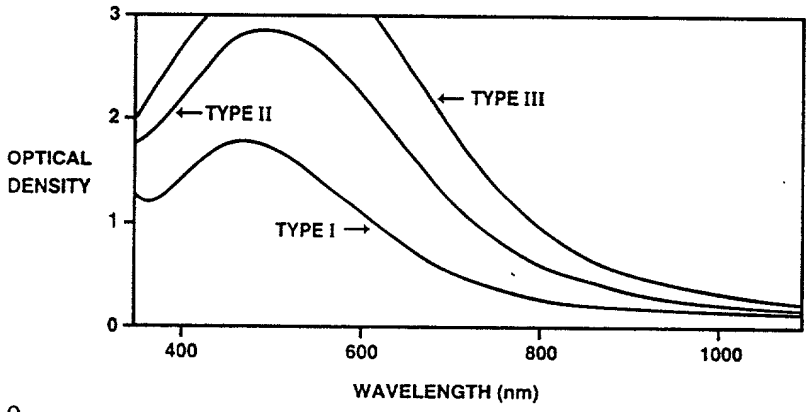


Fig.19

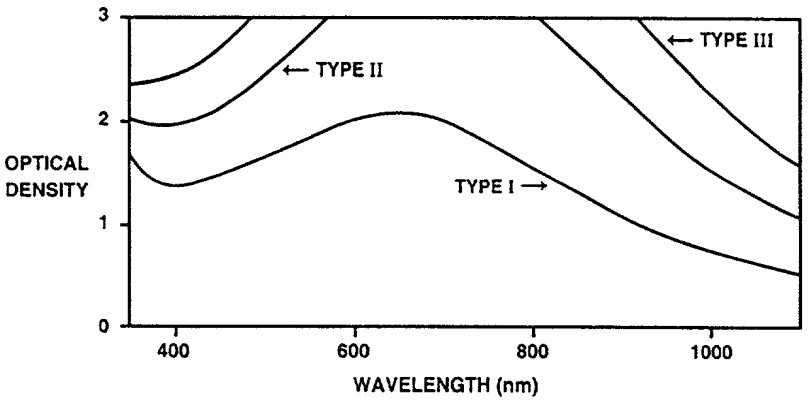


Fig.20

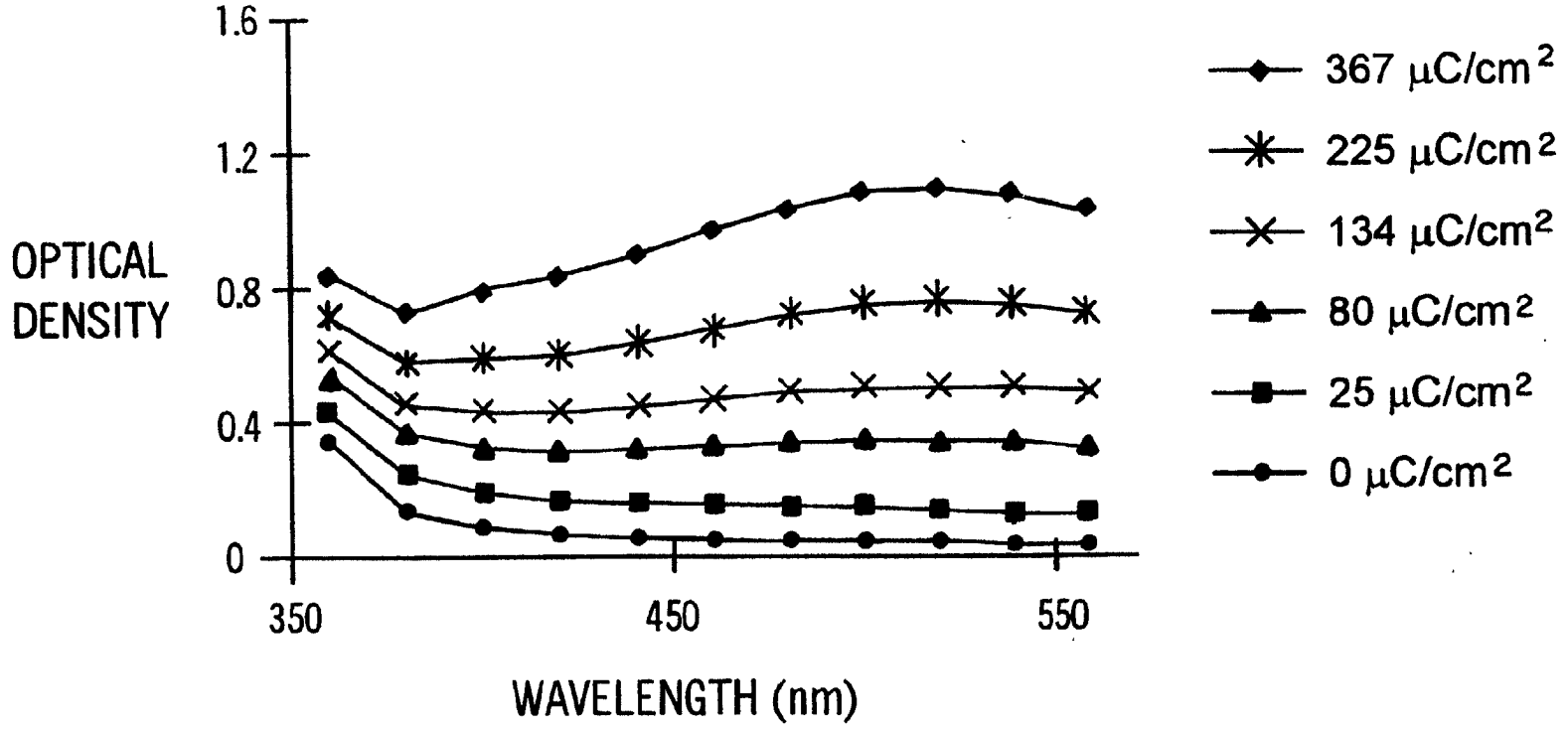


FIG. 21

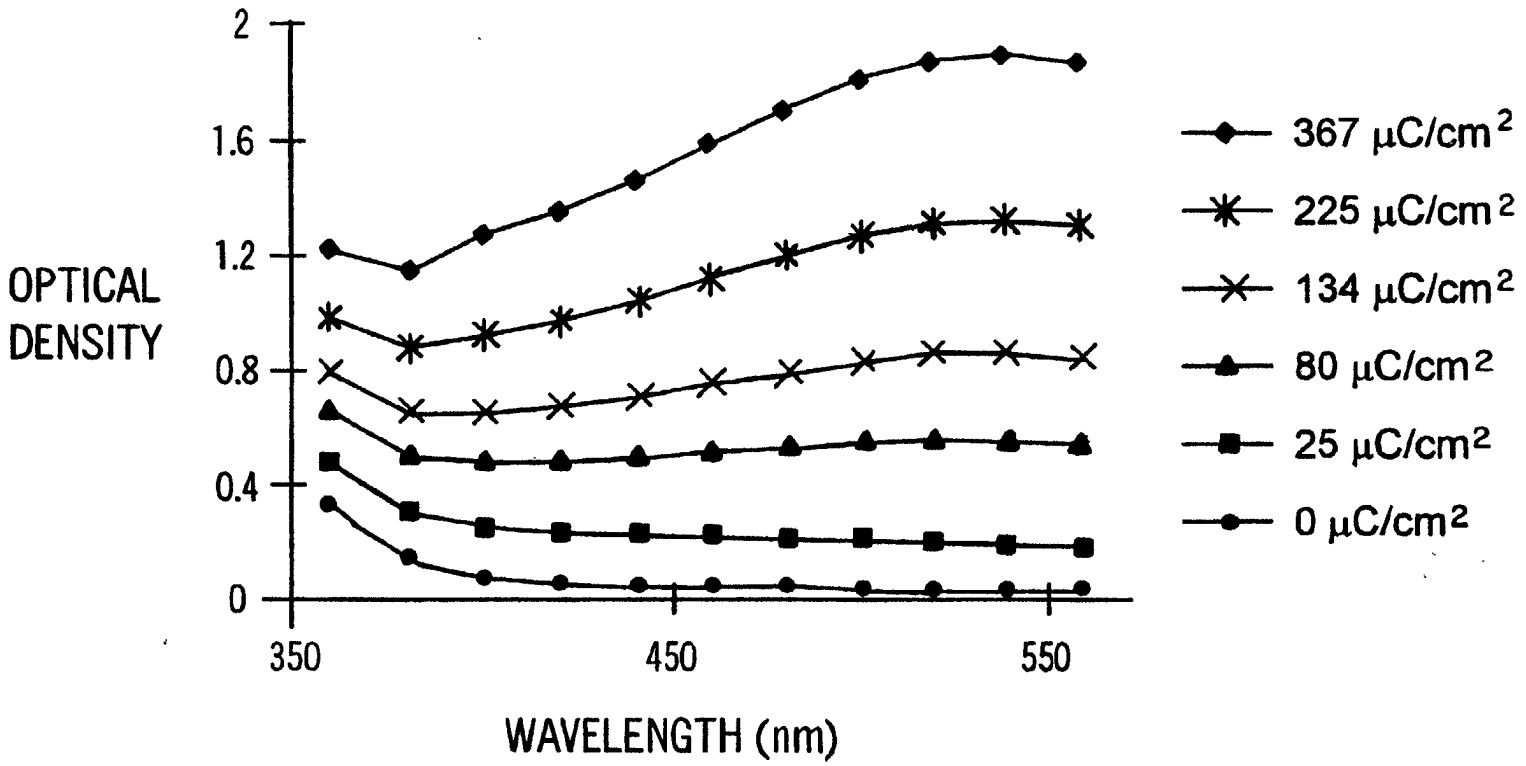


FIG. 22

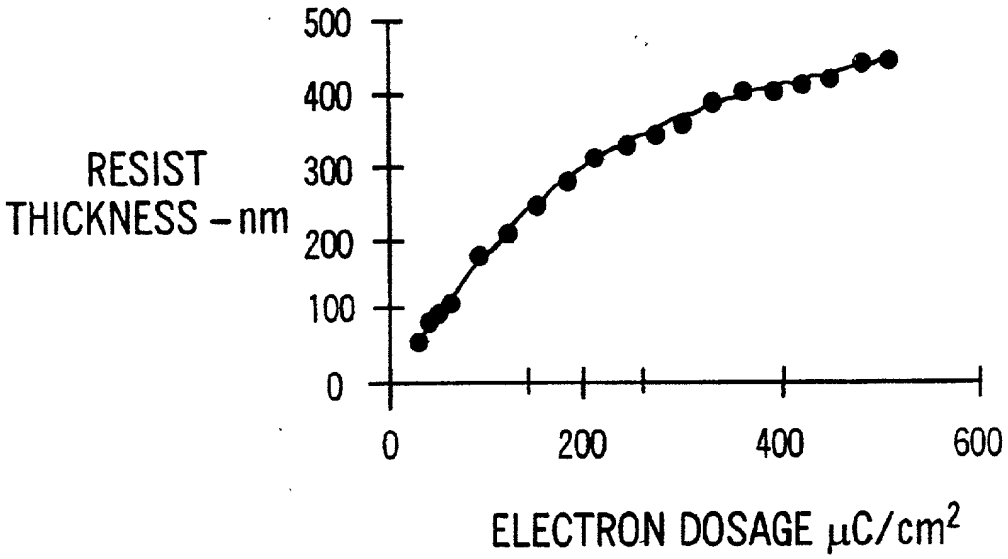

RESIST
THICKNESS – nm
500
400
300
200
100
0
0
200
400
600
ELECTRON DOSAGE μC/cm²

FIG. 23

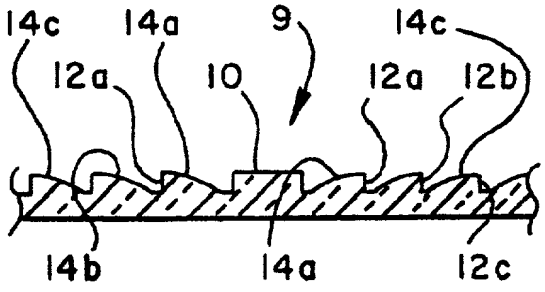

14c
14a
9
14c
12a
10
12a
12b
14b
14a
12c

FIG. 24

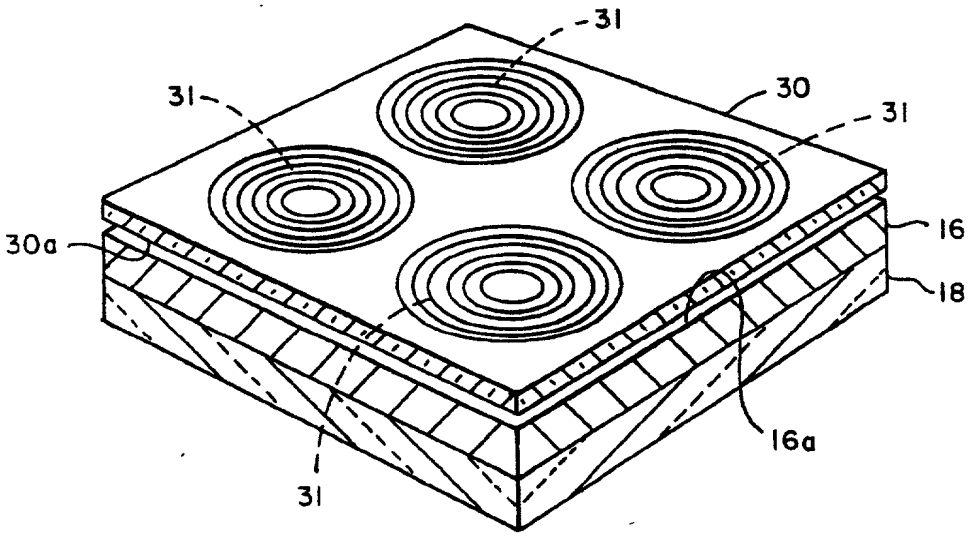


FIG. 25A

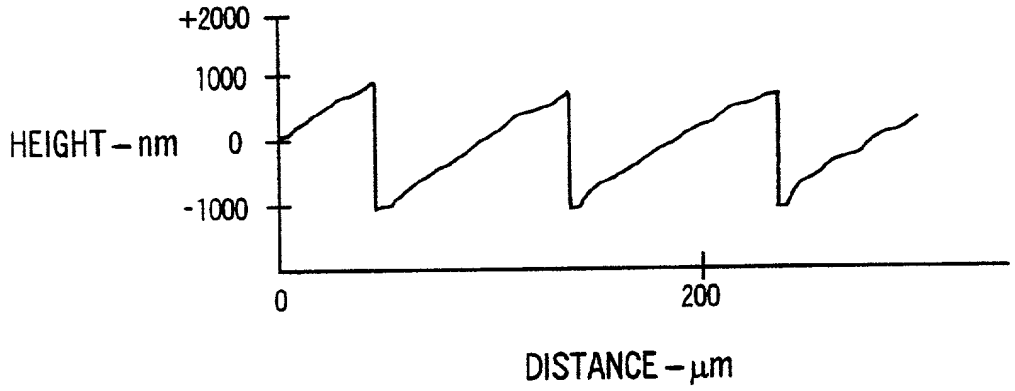


FIG. 25B

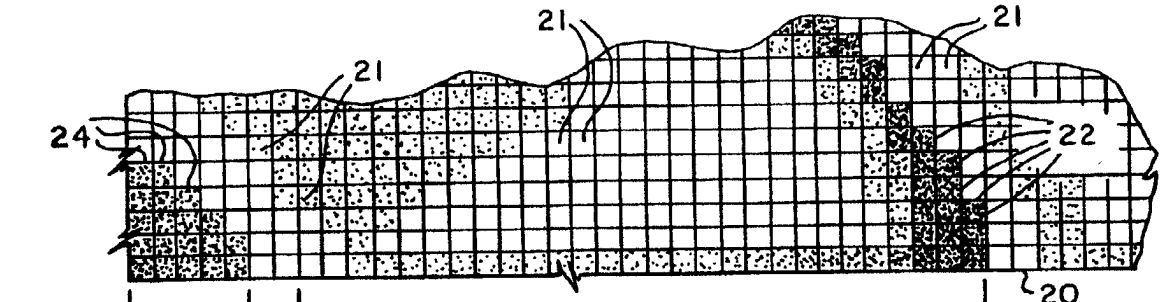


FIG. 26

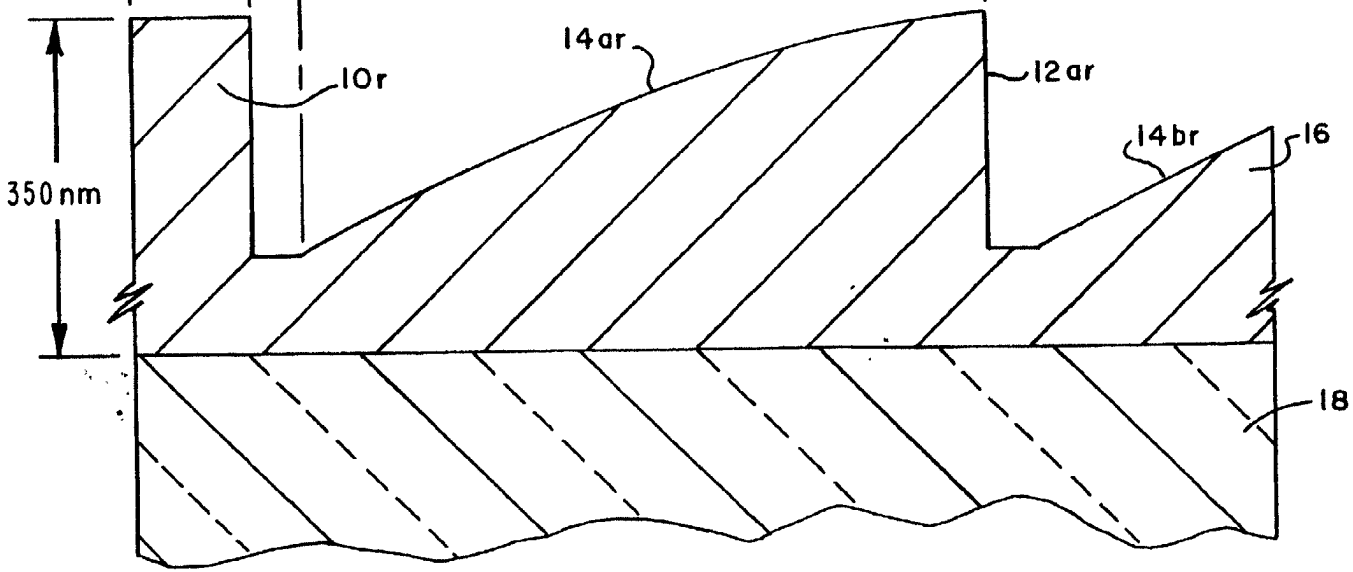


FIG. 27